1-1-1891

Black spruce : preliminary report

A. D. Hopkins

VOL. II. NO. 5.

Bulletin No. 17.

OF THE

WEST VIRGINIA

Agricultural Experiment Station,

MORGANTOWN, W. VA.

PRELIMINARY REPORT.

BLACK SPRUCE.

—BY—

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MAY, 1891.

CHARLESTON.
MOSES W. DONNALLY, PUBLIC PRINTER.
1891

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FOREST AND SHADE TREE INSECTS. II.

Black Spruce (*Picea Mariana*).

Preliminary Report.

As stated upon another page while passing through Randolph county on our journey of observation and collection, in July, we first learned of the destruction of the spruce timber in that section of the State; the cause of which no one seemed to know; evidently some disease or insect attack was threatening the spruce forests with total destruction. On returning to the Station and reporting the fact, a special trip was ordered. Accordingly on August 25th to August 28th, inclusive, a journey was made in company with the Botanist of the Station by rail and stage, into the Spruce forests of Cheat Mountains at a point called Winchester, on Shafer's Fork of Cheat River in Randolph county, for the purpose of making a special investigation of the unhealthy and dying condition of the Black Spruce timber in that region.

A portion of this forest was passed through on the West Virginia Central R. R. in Tucker county on the 25th, where great numbers of dead spruce trees were noted, and where extensive saw mills were at work converting millions of feet into lumber. We arrived at Elkins, the terminus of this railroad, late at night on the 25th. On the afternoon of the next day we proceeded to Huttonsville by stage, where we remained on account of rain and floods until the morning of the 28th.

Proceeding again by stage on the Staunton pike, we entered the forests in which the investigations were to be conducted eleven miles from Huttonsville at an altitude of 3,425 feet. The timber here along the road had been cut and converted into lumber; this cutting, however, only extended a short distance after which we entered the forest in its natural state. Passing through this some three or four miles it was noted that over half the timber along the road was dead and in all stages of decay. At one place along this road our driver pointed out the site of the first saw mill in this region; it having been brought there by the soldiers during the late war for the purpose of sawing lumber for their winter camp; beyond this, we came to the battle field of Cheat mountain, a clear and open

spot on top of the mountain. Here an extended view was had of the Cheat mountains extending on all sides with the blue Alleghanies beyond. Thousands upon thousands of acres of what must have once been a magnificient black-green forest of living spruce, was now viewed as an immense waste of dead and decaying trees, presenting a desolate and dreary landscape. Viewing this, we began to realize the destruction of this valuable timber, and how powerless man would be in an effort to apply a remedy for such a wide spread attack. From this point, the descent of the mountain was commenced, and Winchester or Cheat bridge—our destination—was soon reached; a postoffice, a store and a logger's camp is located here, where 45 to 50 men and 10 teams are employed by a Michigan firm to cut spruce logs, of which about ten million feet are run out each year. Seventy-five thousand acres of this spruce is here owned by this firm, fifty thousand acres of it being leased to the Sportmen Association of Cheat Mountains. The famous club house of this Association is located a mile and a half above the bridge. These are the only habitations along the river for a distance of 50 miles. The altitude at the river is 3.310 feet. Arriving here in the evening, nothing was attempted in the way of investigation until the next morning other than to make some inquiry as to the general supposition regarding the cause of the death of the timber. Among the many opinions expressed, one was that the trees had lived their natural life and were dying from old age; another that it was some disease; but the most general opinion was that it was caused by the drought of 1883(?) Some one had told them that insects were the cause but they did not credit the statement. The next morning a hatchet was procured and the investigation commenced on the first dead tree found, a vigorous application of the hatchet revealed at the first stroke evidence of serious insect attack, which upon further search was found to be the work of Scolytidae bark and timber beetles; species of which were known to have destroyed extensive forests in Germany, France, Canada and New England, hence possibly the cause of the great destruction that had been going on this region. Convincing proof, however, must be found in a tree that was dying from such an attack, none being seen, a careful search was then commenced. In tramping through the forest, over rock and logs, and tangled laurel thickets, we were forcibly impressed by the fascinating scene that surrounded us. The timber is almost entirely spruce and in all stages of growth. The soil (?) is one continued pile of boulders and rocks covered by a dense growth of club and other large growing mosses whlch concealed treacherous holes in which we would sometimes sink to our knees or waists, making walking, away from the regular roads and paths, both difficult and dangerous. On this damp moss-covered rocky surface, the spruce grows, their roots extending down through the crevices where they find abundant moisture in the ever running water of thousands of mountain springs. Years ago this forest was called by travelers the "Shades of Death," suggested perhaps by the dense black foliage of the spruce and the thick undergrowth of laurel, where old, pros-

trate and decaying trees were seen frequently three and four deep covered by a thick damp mantle of moss, in which other vegetation attempting to grow would soon fade and die. As we view the destruction that had been going on here among the trees within the last few years, we see that in reality a shadow of death had passed over this region, the cause of which it was now our duty if possible to determine. Although the dead trees on every side bore abundant evidence that the timber had been killed by insects, no trees could be found actually dying from such effect, until we reached the top of a mountain where the loggers were at work, here the object of our search was found, being a small tree about eight inches in diameter not yet entirely dead. Procuring an ax the tree was felled and abundant and convincing proof of the cause of its death was found when a portion of the bark was removed revealing hundreds of little insects which had mined through the bark in all directions checking the flow of sap thus causing the death of the tree. Beetles were also found in the green bark and sap wood. The men who were watching the operation with evident curiosity and interest admitted that they were convinced and expressed wonder that they had never discovered the fact. Sections of this tree were cut, which were kindly carried to the camp by the men who offered any further services we might desire. Mr. Steel, the foreman of the camp, being especially kind in giving us assistance and information. Farther search was made for dying trees and a number of others were found, where swarms of small gnats were observed flying around the trees and alighting on the bark. Supposing these to be parasites careful search was made in the bark, where the same insects were found in the mines of the bark borers on which they had evidently been feeding. Several other species of insects were also found feeding on these bark borers. We had thus found the possible and evident cause of the timber dying, and the probable natural remedy which had checked this cause and prevented further destruction. Much, however, remains to be studied out before convincing proof can be had as to which species should be changed with their death, and which should have the credit for the better condition of the forest. These trees were again visited on September 1st, the bark carefully examined, and sections of the trees cut and sent to the Station for further study. On returning to the Station, these sections were placed in large cylindrical glass jars, the mouths of which were covered with coarse muslin secured by rubber bands. I have thus been able to note the insects which have since emerged from the sections. I am now in correspondence with timber men in different sections of the forest with a view of securing additional information; and with Profs. Riley and Howard of the U. S. Division of Entomology, to whom I sent examples of the insects taken in the forest, and from the breeding jars, for determination. They have kindly determined such of them as were known; several of them proving to be new species. A list of the insects taken, with cuts and descriptions of the principal injurious and beneficial ones, will appear

later in a special bulletin on this investigation. I will probably visit the forests from time to time until the investigation is completed.

It is hoped and believed that with a further knowledge of the parasites of the spruce Scolytidæ and their habits, that they may be successfully introduced into forests where the trees are just commencing to die and thus prevent a wholesale destruction of the timber.

EXTENT AND DISTRIBUTION OF THE SPRUCE FORESTS OF WEST VIRGINIA.

Valuable information in regard to the extent of the forests was obtained from Col. E. Hutton, who is an extensive land owner and dealer and is thoroughly acquainted with the land and timber of the mountain regions in this section of the State. According to his estimate, the spruce forests are distributed as follows:

Randolph county,	15,000	acres on Elk and Gauley waters.
	120,000	acres on Cheat River waters.
	5,000	acres on Mill creek.
	500	acres on Elk mountain.
Pocahontas county,	20,000	acres on Shafers' Fork of Cheat.
	100,000	acres on the head of Greenbrier.
	100,000	acres on Gauley and Elk head waters.
Tucker county,	50,000	acres on Cheat waters.
Mineral county,	25,000	acres.

Greenbrier county, 33,499 acres by actual survey, on Cherry Tree river, making a total of nearly 500,000 acres, or about 800 square miles of spruce forest. He thinks the actual amount will go over rather than under this estimate. His estimate that there were 25,000 acres in Greenbrier county, was proved by actual survey to exceed that amount over 8,000 acres.

INFORMATION CONCERNING TIME WHEN TIMBER COMMENCED AND CEASED DYING IN CHEAT REGION.

Col Hutton stated that he observed trees commencing to die in the Cheat region about ten years ago, or between 1880 and 1882, the destruction continued for five or six years, the trouble spreading until over 300,000 acres was more or less affected. He farther stated that the timber did not die over all the forest alike; but in patches of from 60 to 1,000 acres, and that the largest and best trees seemed to be more frequently affected than the smaller trees. Mr. Hanbric, who is the game-keeper of the Sportsmen's Association, says that he has spent almost all his life in these forests as a hunter, and that he has been observing the spruce timber for the last ten years. He says that in the summer of 1882 there was a very severe drought here, that in October following the timber commenced to die, continuing through the winter and much worse the following summer, the trees then died scatteringly until 1885. No trees to his knowledge have died here within the last three years;

but he observed last fall that they had commenced to die in Pocahontas county where the timber had been heretofore unaffected.

INFORMATION CONCERNING CAUSE OF DEATH OF TREES.

The general supposition by people living here is that the timber died from the effect of the drought of 1882, some claimed that the trees had come to maturity and were dying from old age, giving giving their reasons that the larger trees seemed to die worse than smaller ones, while a very few thought that it might have been caused by insects. Col. Hutton has obrerved that at certain times in the year, while the timber was dying the air would be full of little "bugs;" that from the numbers would get in one's hair and be otherwise annoying. He had cut into green logs and trees and found "bugs" in the sap wood, thus concluding that they had something to do with the death of the trees. He supposed, however, that the other insects found in the bark only attacked the trees after they were dead.

Captain Parsons, a railroad surveyor who has conducted surveys through this forest at different times, stated that he had often observed that in a few years after they made such a survey the timber commenced to die on either side of the path made by the hacking and cutting necessary in their progress through a forest of this kind, and that if small bushes or trees were cut and lodged against living ones would often cause them to die.

Mr. S. L. Riger, of Phillippi, who has observed the spruce forests before and after the trees commenced to die, stated that his theory as to the first cause of the trouble was, that the deer hunters made burnings in the forests from which the green trees would commence to die on all sides and the trouble would continue to spreed until checked by some unknown cause. He said that it was supposed by some that the trees had lived their natural life. Others supposing that their death was from drought, others that it was caused by a "bug," and still others who were confident that the trouble was caused by a fly which they had observed flying around the trees. He further stated that the trees seemed to die worse in the fall and winter than at other times.

ANSWERS TO CIRCULAR LETTERS.

In answer to the following questions mailed to lumber and timber companies operating in the spruce as to when the timber commenced to die in their respective localities.

No. 1, Huling Lumber Company, Tucker County: answers within ten or fifteen years.

*No. 2, Black Water Lumber Company, Tucker County, about 1887.

*No. 3, Silas Sharp, Pocahontas County: In the year 1887.

*These localities are widely separate from that in which the investigations here reported were made; no general drought has been reported since 1882.

No. 4, St. Lawrence Company, Greenbrier County, 1883.

As to the cause of their death:

No. 1, answers: Don't know; worms.

No. 2, answers: Everybody gives it up.

No. 3, answers: The general opinion is on account of drought. The "Pine" generally grows in rocky places, and there was not dampness enough to keep the trees alive.

No. 4, answers: Two very dry summers in succession.

Are the trees dying at the present time:

No. 1, answers: Yes, to some extent.

No. 2, answers: It is said not. Said death is checked.

No. 3, answers: Not more than common.

No. 4, answers: No.

How long does the timber continue to die in one locality?

No. 1, answers: About three or four years:

No. 2, answers: Generally one season.

No. 3, answers: Two years:

No. 4, answers: About three years.

What proportion of the timber in your locality is now dead?

No. 1, answers: One-fourth.

No. 2, answers: Twenty-five per cent.

No. 3, answers: The highest points of timber.

No. 4, answers: 15 per cent.

What is the present value of standing dead trees for lumber, and what is the probable time in which they may yet be profitably worked.

No. 1, answers: About equal value for three years: After that time it very rapidly deteriorates.

No. 2, answers: It depends on time of cutting after date.

No. 3, answers: The dead timber is as good for lumber as if it was green. It will be good for a year yet.

No. 4, answers: About two-thirds of the value of green timber. Will be good yet for four or five years.

Mr. Hugh Maxwell, of Tucker County, an observing and intelligent gentleman, answers as follows:

"I can state two or three facts:

1st. The spruce timber in the affected districts is nearly all dead. There are certain strips, however, unaffected.

2nd. They use the dead timber for pulp from which to make paper. This is now an extensive industry here.

3rd. It is the prevailing opinion here that the death of the trees is due to parasites.

4th. It seems that wild cherry is replacing the dying spruce."

PERSONAL OBSERVATIONS.

Trips were made in all directions from Cheat Bridge. Dead trees were examined in all stages of decay. Stumps and tops examined in cuttings of 1884, 1887, 1888, 1889 and 1890. Their condition as to insect attacks and decay and the time of year in which the tim-

ber was cut was carefully noted. Every species of insect which seemed to be in any way connected with the spruce as taken, and notes made on their habits as far as observed, (which will be reported later).

Past history of the ravages of these insects in the spruce forests of this and other countries and the information that I have obtained from personal observation and inquiry, indicate that such wholesale destruction of timber always follows some great injury to the forest by storms, fires or drought. This we may account for in the following manner: The species of scolytid bark and timber beetles, which are supposed to be the main cause of the trouble, no doubt have a preference for injured trees or recent prostrated limbs, in which they are always more or less plentiful, and in such they may continue to breed for many generations, increasing or decreasing according to the supply naturally furnished by an occasional uprooted tree or broken limb, never being allowed in the natural order of events to increase sufficiently to attack and and kill the healthy trees. When, however, something unusual occurs to injure any large amount of timber, nature is then thrown of her balance, and no longer preserves natural order, and an equal division her species. The insects which have so long been prevented from increasing to their full extent by the meagre supply of natural food, lack of favorable conditions, and occasional attack of their enemies, now furnished with abundant breeding ground, and favorable conditions in the injured forest, increase with astonishing rapidity.* By the third year, they will have increased to countless numbers, taking the character of an invasion, attacking trees and continuing on their march of destruction like a victorious army through an enemies country until checked by reinforcements in the ranks of their natural enemies.

It is therefore possibly a fact, as is generally supposed, that the extreme drought of 1882 and 1883 had something to do with the wholesale death of the trees which occurred in certain localities in the Cheat mountain forests between 1882 and 1886. The timber on the extreme rocky points no doubt was thus very materially injured, many of the trees dying from the effects of the drought alone, thus forming a nucleus from which an invasion of the beetles might extend to and destroy living trees. This was evidently the case in the locality mentioned. Points were found here so rocky that it seemed almost impossible for the roots of the trees to find either soil or moisture. Trees that once flourished on these points were now dead, and in an advanced stage of decay. Were these dry points the only places where trees were found to be dead, we might safely infer that the drought was the cause of their death; such we found was probably not the case, as the characteristic dead trees were observed on river bottoms, deep and fertile soil and even in swampy places in the infested districts.

These affected portions of the forest from 50 to 1,000 acres in ex-

*It is estimated that these scolytids will increase from one female at the rate of 1,800 the first year, 8,010 the second year, and 729 million the third year.

tent, are located indiscriminately through the forests separated by tracts of green timber of greater or less extent. Old White Top Mountain near Cheat Bridge seems to have been the nucleus of the trouble in that region. The clearing made by a pioneer settler on this mountain, the opening of the Parkersburg and Staunton turnpike through the forest here, the old saw mill and the camps of General Reynolds' soldiers located here in the winter of 1861, the injuries by the three engagements of September and December, 1861, followed by forest fires, storms and drought in later years, furnished a succession of favorable conditions for the increase of the injurious scolytids, so that when the drought of 1882 impaired the health of other portions of the forest on this mountain, hosts of these beetle were ready to attack the injured trees from which they seem to have spread to those that were healthy and green, thus resulting in the wholesale death of thousand's of dollars worth of valuable timber.

PROBABLE EXTENT OF THE DAMAGE.

Colonel Hutton stated that about a 75 per cent. of 170,000 acres on Cheat waters and 10 per cent. of 140,000 acres on Gauley and Elk waters were dead. S. L. Riger, of Phillippi, stated that two-thirds of the 100,000 acres on Cheat waters was dead. From my own observations, I should judge that forty per cent. of the trees were dead of the 15,000 to 20,000 acres near Cheat Bridge. Col. Huttons' estimates are probably as near correct as it is possible to get them, from these we judge that at least 1,500,000 dollars worth of timber is now dead in the spruce forests of West Virginia.

PRESENT VALUE OF DEAD TREES FOR LUMBER AND TIME THEY MAY BE PROFITABLY WORKED.

Statement of Mr. George Steel, of Winchester, W. Va., foreman of an extensive logger's camp:

"I have been here three years. We keep on an average 45 men and 10 teams. We cut and run into the river about ten million feet of logs each year. We have been cutting these dead trees right along, and I can not see much difference as to decay. The dead trees that we are cutting now will make very good lumber, and it is my belief that they will be good for lumber for at least three years. No large trees have died in this locality to my knowledge since I have been here."

On visiting the extensive saw-mill belonging to the same company located at the mouth of Cheat river, the following statements were obtai ed from Mr. Kysor, superintendent of the mill:

"The first logs we sawed here was in August, 1889, about 200,000 feet of which was felled in 1884 and 1885, only about 5 per cent being discarded or thrown into the slab pile. The logs from trees of this cutting that were dead when felled made third-class lumber. The logs sawed last spring were from trees cut all the way from first

to third-class lumber; a much less per cent being discarded in this last sawing than in the first. There is now in the yard out of three million feet sawed: 2,000,000 feet of first-class lumber and above, 700,000 feet of second-class lumber (piece stuff and weather-boarding) and 100,000 feet of third-class lumber. This lumber sells here at an average of about $12 per thousand. The third-class sells for $8 per thousand. and we sell more of it in proportion than we do of firsts and seconds.

PERSONAL OBSERVATIONS.

From a careful examination of the trees in the healthy and affected districts and of the stumps and tops in cuttings of 1861 and 1884–1890, a tolerably correct idea of the durability of the timber was formed, from which, I should judge that where these affected tracts are accessible to a railroad or stream large enough to float out logs, that this timber may be profitably worked within eight years after it dies.* It is therefore possible that much of this timber might be saved. From the fact that large companies are now operating in it, and that thousands of acres of these affected portions of the forests, together with healthy portions, may be bought very cheap, and within the next three or four years no doubt much of this timber could be worked at a profit to operators, and a great saving gained thereby. We would therefor suggest that the districts already dead should be felled and converted into lumber as soon as possible.

When it is considered that the scarcity of spruce and other timber of the world is becoming an alarming matter, the saving of a portion of the immense amount of timber which is now dead should certainly receive the universal attention of foresters and others who are interested in the preservation of the great forests of West Virginia, for practically every dead tree converted into lumber or pulp 'ere it decays saves its value.

Summary.

The spruce forests of West Virginia are estimated to exceed 500,000 acres.

Isolated portions in these forests are dead, possibly to the amount of 150,000 acres.

While conducting an investigation in one of these affected portions, all of the characteristic dead trees there bore abundant evidence of the attack of insects belonging to the family Scolytidæ.

A number of small trees were found partly dead, and dying near where trees had been cut last summer.

Great numbers of bark and timber beetles were found in the bark and sap wood of these dying trees both in the green and dead portions.†

*This statement applies only to this Cheat Bridge region. In other portions of the forests, especially in Tucker county, the timber rots quite soon after death.

†Principally Polygraphes rufipennis, Kby.; and Xyloterus bivittatus, Kirbey

Three species of parasites* of these beetles were plentiful, and were noted flying around and on the bark of the infested trees. Some of them were observed with their ovipositors inserted into the bark, while others were entering and emerging from the burrows made by the beetles. Here evidence was obtained of the possibility of these beetles being destroyed or reduced by natural means to such an extent that they could no longer be destructive to trees.

These same beetles were found very plentiful in the logs, stumps and tops of last summers cuttings, near these dying trees.

There was very little evidence of the attack of these beetles on the stumps and tops of the 1887 cuttings, indicating that at or near the time that the timber ceased dying in this locality these insects were not plentiful.

Conclusions.

The conclusion arrived at from personal observation and notes leads me to believe that the death of the trees is probably due to the combined effect of two causes.

1st. The ravages of the insects primarily succeeded some injury to probably a few trees in isolated localities.

2nd. When the conditions were no longer favorable to their existence in the injured trees, and they had increased to great numbers, the possibility of their attacking the healthy trees from sheer necessity and continuing to spread until checked by some natural cause, seems to me evident. I reach this conclusion from the fact that I have found these same scolytids working in the green, sappy wood and bark.

Still further investigations will be made in the spruce forests of the State in this and other localities, and a final report will appear in a future bulletin. This bulletin will also contain a list of all insects taken in these forests, and such other additional facts as may be determined.

*Species—Trigonoderus, Helorus, and Spintherus, n. sp.